FOREST RESEARCH NOTES

CALIFORNIA FOREST AND RANGE EXPERIMENT STATION
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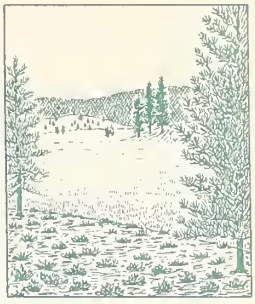

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FREEZING INJURY TO SUGAR PINE CONES

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Evidence that immature sugar pine cones are killed by severe late spring freezes was observed for the first time on the Stanislaus Experimental Forest in 1954. Although extremely low temperatures previously were suspected to have destroyed young sugar pine cones, no definite instances are known to have been reported heretofore.

In August 1954, at the time of the annual cone count in the experimental area, many small cones were observed on the sugar pine trees. At first glance, these appeared to be green conelets that would mature in 1955. Upon closer examination, they proved to be brown and slightly larger than green first-year conelets on the same trees. On the ground beneath the trees, several of these brown cones were found. None had the resin globule on the stem characteristic of cones killed by larvae of the sugar pine cone beetle (Conophthorus lambertianae Hopk.). Furthermore, these brown cones were much smaller than insect-killed cones and showed no visible cause of death (fig. 1).

Figure 1.
Sugar pine cones:

A. Normal appearance in August of second year.

B. & C. Killed by sugar pine cone beetles.

D. Killed by a severe June freeze.

Records from the nearest weather station were examined for clues to the cause of damage. The recording station is about 2.5 miles northwest of the study area and about 1,000 feet lower in elevation. The weather station and the study plot were in different drainages, but both were on south-facing slopes. A minimum temperature of 20° F., an unusually low temperature, was recorded for June 6 in the weather instrument shelter 4.5 feet above the ground level. This freeze, which occurred after trees around the shelter had started to grow, killed most of the new shoot growth, particularly on the white firs. The maximum and minimum temperatures during the 30-day period immediately preceding the freeze were:

	Maximum (°F.)	Minimum (°F.)
Average	70	35
Range	47-84	27-45

Although the exact minimum temperature in the crowns of the study trees is not known, it probably was as low or lower than at the recording station.

Not all of the immature sugar pine cones were affected by the freeze. Approximately 8,400 cones were counted on 95 trees. Of these cones, 1,485 were classified as frozen. The frozen cones occurred on 35 percent of the trees, generally isolated individuals. Losses appeared to be higher in the upper halves of the crowns, but no cone counts were made to verify this observation. A substantial part of the frozen cones--46 percent--were found on a single, isolated, 49-inch tree. This tree was situated about midway on a southeast slope. More than 93 percent of the cones on this particular tree appeared to have been frozen.

Although sugar pine cone crops have been observed for the past 29 years on the experimental forest, the occurrence of frozen cones has never been reported. Probably some frozen cones have been erroneously classified in the past as "next year's cones." Therefore, losses resulting from late spring freezes may explain why some cone crops were lighter than predicted or failed completely.